

Mayer of Bethlehem, the Medical News and Penn. Monthly, Peabody Institute in Baltimore, Surgeon General's Office in Washington, the Publishing Bureau of the U. S. Commissioners to the Paris Int. Exp. of 1867, War Maps from the Chief Engineer's Bureau in the War Office, a map of Ohio from Prof. Newberry, and the Annals of the Buenos Ayres Public Museum.

The Committee to which was referred the paper of Dr. Horatio C. Wood on Fresh water Algæ, reported in favor of its publication in the Transactions. The subject was, on motion, referred to the Publication Committee with instructions to report at the next meeting.

An obituary notice of Mr. Franklin Peale, a late member of this Society, was read by Mr. Robert Patterson.

An obituary notice of Mr. Samuel Vaughan Merrick, a late member of this Society, was read by the Rev. Dr. Goodwin.

Prof. Cope made a communication on certain extinct Astici from the Fresh water Tertiary of Idaho. And another on four species of Pythomorpha from the Cretaceous of Kansas.

The reading of the report of the Finance Committee was, on motion, postponed to the next meeting.

Mr. Marsh, Treasurer of the Building Fund Trust, presented the annual Report of the Trustees.

Pending nominations 661 to 668 were read.

Motions for appropriations for the ensuing year were postponed to the next meeting.

And the Society was adjourned.

ON SOME SPECIES OF PYTHONOMORPHA FROM THE CRETACEOUS BEDS OF KANSAS AND NEW MEXICO.

BY PROF. E. D. COPE.

Read before the American Philosophical Society, December 18th, 1870.

LIODON DYSPELOR. Cope.

Species nova.

This species is represented by numerous vertebræ of the dorsal, lumbar, and caudal regions, and other remains, which will at a future time be more fully described than is possible at present. The vertebræ indicate the largest Mosasauroid reptile known, and are remarkable for their form as well as size.

The centra of the dorsals are much depressed, quite as in *L. perlatus*, Cope, and *Mosasaurus brumbyi*, Gibbes. Their articular faces are of transverse lenticular form, the superior arch being a little more convex than the inferior, and obtusely emarginate for the floor of the neural canal. The superior outline is thus bilobed; the lobes rounded. The transverse curvature of the articular ball is quite regular, and not, as in *Mosasaurus maximus*, more steeply inclined at the external or lateral angles. A rather broad, smooth band separates the edge of the ball from the surfaces of the centrum adjacent. The latter are rather finely striate ridged from the edge of this band. The inferior outline of the centrum is strongly concave, and with two venous foramina separated by a wide interval. The basis of the diapophysis on a lumbar is very broad, measuring more than half the length of the centrum. In general characters this lumbar resembles the dorsal, including the emargination for the neural canal, but is shortened in relation to its length.

The depressed form of the lumbar centra gives place gradually on the caudals to a more elevated pentagonal outline, which is still more reduced in width in more posterior regions. The hæmal arches are articulated, and on the anterior caudals to slightly elevated bases; on the more posterior, the bases are reduced in height, and more widely and deeply excavated. I have not seen the most distal caudals, and hence cannot determine whether their chevron bones articulate in pits, as is the case with those of *L. perlatus*, *L. proriger*, etc. On a caudal where the depth of the centrum a little exceeds the transverse diameter, the diapophysis has become narrow and thick. The excavation for the neural canal is strongly marked on the more anterior caudal. The smooth border of the articular ball is here narrow, and the superficial rugæ are fine, and confined to the anterior part of the centrum.

<i>Measurements.</i>		<i>M.</i>
Transverse diameter ball posterior dorsal.....		0.144
Vertical "097
" " anterior caudal.....		.094
Transverse " " "107
Length centrum caudal.....		.071
Transverse diameter neural canal.....		.0145
" " basis diapophysis.....		.032
" " " " of a more distal caudal....		.0278
Longitudinal diameter chevron articulation of caudal.....		.023
Length centrum.....		.068
Depth ball centrum.....		.093
Width " "091
Length centrum of a lumbar.....		.106
Width of articular ball.....		.125

In instituting a comparison between this and other known Mosasauridæ, it will be necessary to consider species referred to *Mosasaurus* as well as to *Liodon*, from the fact that some of the former may really be *Liodons*.

The Liodons with compressed or round dorsal or lumbar vertebræ may be dismissed from comparison. Of the depressed species, *L. perlatus*, Cope, is known from specimens of one-third or less the size of the present one, which are further peculiar in having the diapophyses of the lumbar to stand on the anterior half only of the centrum. In *L. ictericus*, Cope, the centra are less depressed, and the size still smaller than in the last.

Among Mosasauri with depressed vertebral centra, it is to be noted that none present so great a degree of depression and lateral extension except the *M. brumbyi* of Gibbes. They are all also much smaller. The *M. brumbyi* was founded by Dr. Gibbes on two lumbar vertebræ from the Cretaceous of Alabama, which resemble those of the *M. dyspelor* in form, and also in size. It is probably its nearest ally, and may be a Liodon. Dr. Gibbes established the genus Amphorosteus for it, but without sufficient evidence to support it. The principal point of distinction between it and the *L. dyspelor* which I observe is the lack in the former of the strong emargination of the superior margin of the articular surface for the floor of the neural canal, which is so marked in the latter. I have only the figures of Gibbes to rely on for this particular, and it is scarcely probable that the artist would have overlooked it had it existed. Should the bounding prominences have been worn off, then the restored centrum would have had a notably greater vertical diameter than in the *L. dyspelor* in the same portions of the vertebral column. As a second character, I note that, relying as before on Gibbes' figures, the external angles of the depressed ball are not so extended laterally in *M. brumbyi*.

In size the vertebræ of the present animal exceed those of the *M. brumbyi*. The latter has been hitherto the largest known species of the order Pythonomorpha, exceeding two-fold in its measurements the *M. giganteus* of Belgium. So the present saurian is twice as great in dimensions as the New Jersey species I have called *M. maximus*. If, as appears certain, the *M. missouriensis* discovered by Webb measures seventy-five feet in length, the *M. maximus* measured eighty, and the *M. dyspelor* could not have been less than one hundred feet in length. This is much the largest reptile known, and approaches very nearly the extreme of the Mammalian growth seen in the whales, though of course without their bulk. Such monsters may well excite our surprise as well as our curiosity in the inquiry as to their source of food supply, and what the character of those cotemporary animals preserved in the same geologic horizon.

The locality whence this reptile was procured is near Fort McRae, in New Mexico. It was discovered by Dr. W. B. Lyon, surgeon at that post, and by him sent to the Army Medical Museum at Washington, whose director placed it in the collection of the Smithsonian Institution. The attention to the palæontology of his neighborhood by Dr. Lyon will always be cause of satisfaction to students, and his name will be remembered with that of Turner (discoverer of the *Elasmosaurus platyrurus*, Cope), Sternberg, and others.

The stratum is the yellow chalk of the upper cretaceous, which has yielded the *L. ictericus*, *L. proriger*, *Polycotylus*, etc., in Kansas, and of

whose western extension into New Mexico, the present species is evidence.

LIODON ICTERICUS, Cope.

Char. External angle of the os quadratum close by the meatus, and continued as a rounded ridge separating the anterior and external faces of the bone. Median posterior ridge not prominent. Centra of dorsal vertebræ depressed. Humerus broad, short.

Description. This species is represented by portions of cranium, as postfrontal, suspensorial, pterygoid, articular, and quadrate bones; by parts or wholes of several vertebræ, which are all dorsals, and by scapula and coracoid with many elements of the fore limb. The latter include humerus, radius, a carpal and numerous metacarpals and phalanges.

The species is first well characterized by the form of the quadrate bone. This element lacks a portion of the ala, and the postero-superior decurved process, but is otherwise perfect. Its form is intermediate between that in *L. validus*, Cope, and *Mosasaurus depressus*, Cope. Its external angle of the proximal extremity is posterior to its usual position, as in the former species, but is less prominent than in it. It extends to near the distal end, disappearing between the extremities of the median posterior, and the distal longitudinal angles. The former of these is short, and it disappears by a gradual descent distally, in a very rugose margin. The distal longitudinal is short and acute, not prominent at the distal extremity. From the posterior position of the proximal external angle, the alar articular surface is somewhat elongate. The postero-external face above the meatus is proportionately short. The meatal pit is scarcely one fifth the usual size, so far as determinable from the present surface, but it is possible that the greater part is filled by an impacted mass of bone derived from the adjacent ridge. The margins of the articular extremities and of the ala are striate and papillose rugose. No meatal knob.

The suspensorium is slender. It is peculiar in the great extent of the exoccipital element, which covers the whole superior surface, and extends externally over the opisthotic to the squamosal, concealing the former except its anterior margin. The proötic sends a small proximal portion only to the superior face.

The pterygoid has been free from its fellow medially. A distal and median portions have been lost; the remaining fragments present bases and alveolæ for eleven teeth. The fangs are rugulose and but little swollen; probably five to seven stood on the lost portions. The bases of the crowns are circular. The external process of the bone is slender and flat.

The portion of the mandible preserved, includes much of the articular, and adherent parts of the angular. The latter forms a narrow band on the lower edge of the external face, and one twice as wide on the inner face. The only characteristic feature is the lowness of the ridge which descends and extends anteriorly from the anterior margin of the cotylus for the quadratum.

Of the vertebræ several are so distorted by pressure as to be uncharacteristic. Two well preserved anterior dorsals have transversely oval articular surfaces excavated openly above for the neural canal. One is from a position anterior to the other, and these surfaces are less oval, though still transverse. The centra of both are very concave in profile below, and expand both inferiorly and laterally to the edge of the cup. A deep groove surrounds the base of the posterior face. In the anterior dorsal the neural arch is preserved. It exhibits an approach to a zygosphen articulation more marked than in any other *Liodon*, and is hence nearer *Clidastes* in this respect as well as in the slender pterygoid. A zygosphen is not separated from the zygapophyses, owing to their connection by a lamina of bone. The notches at the posterior end of the arch for this prominence are marked. The neural spine had a long anterior ala, the base of which extends to the summit of the neural arch. It presents a fine striation vertical to the centrum and oblique to the edge of the bone, as is seen in *C. propython*, Cope. The diapophysis on this vertebra looks obliquely upwards and carries a vertical articular surface which is concave behind. The line of its lower extremity falls the depth of the neural arch below the latter, and of its upper reaches the apex of the canal in front. The more posterior vertebra has as usual a broader articular rib surface, the diapophysis being flattened above and below. The marginal and angular surfaces are striate-rugose on these and the other vertebræ. One of the free hypapophyses of a cervical is preserved. It has a sub-trigonal section and is longer than wide, and obtuse. Its posterior faces are exceedingly rugose.

A cervical rib is compressed and short. Head narrow, large simple, the adjacent sides striate-rugose. Sides with a shallow groove.

The scapular arch is represented by an entire right scapula and proximal part of right coracoid. The former is broader than in any of the species in which I have seen it (four only), and is flat, and thin above. Its anterior extension is greatest below; its posterior above, at the superior angle. The lower posterior margin is strongly concave and thickened. The antero-superior margin is a regularly convex arc of more than 180°. The lower portion in front is on a different plane, and is the rudimental acromion. The articular surface is rugose, and the glenoid cavity not less so.

The proximal portion of the coracoid is flat. It presents the usual foramen near the anterior margin, and the shorter concavity of the anterior margin leads to the belief that the anterior extremity of the bone is the more prolonged as in *Clidastes propython*.

The glenoid cavity is not concave, but merely two adjacent flattened rugose surfaces.

Consequently the *humerus* has no head, but merely an elongate articular surface, which exhibits a median keel and a short angular expansion near the middle. This bone is of remarkable form, more resembling that I have described in *Clidastes propython** than any other, and very different from that described by Leidy in *Platecarpus tympaniticus*. It is a broad flat

* See Trans. Amer. Philos. Soc., 1869, 219. Tab. XII, fig. 17.

bone expanded at the extremities in one plane distally, so as to be as wide as long. In the present individual it is crushed by pressure, so that its thickness is not readily determinable. Its external surface rises into a crest medially at the narrowest portion, which continues to the lateral angle of the proximal end, following parallel to one of the borders. A moderate thickening exists on the opposite side a little beyond the extremity of the crest. Strongly rugose striæ extend to the edges of the articular faces. An oval rugose muscular insertion exists on the least prominent of the distal angles, and not on a process as in *C. propython*.

A bone which from its analogy to the *radius* of the last named species I suppose to be that bone, accompanies the others. It is flat, truncate proximally and with nearly parallel borders on the proximal half. Distally it is obliquely expanded, the outline forming a segment of an ellipse whose axis is oblique to that of the bone. Its extremities are rugose-striate.

One *carpal* remains: it is a quinquelateral bone, one side being marginal and concave. Perhaps it is the intermedial. There are several elements which are probably metacarpals. The general structure of the whole limb may be determined from these and from the numerous *phalanges*. The former are flattened and with oblique extremities; the latter more cylindric, with a transverse truncation. Both have a median contraction, which becomes less marked in the distal ones; these are also more cylindric, entirely so at the distal extremities, which are concave. All of these element are rod-like, much more slender than any of those figured by Cuvier or Leidy. Those immediately following the metacarpals are flattened, but thickened distally.

The number of *digits* cannot be readily determined, but four may be certainly distinguished. The general similarity in construction of the manus to that of a Cetacean mammal is noteworthy.

	<i>Measurements.</i>	<i>M.</i>
Length suspensorium (anteriorly).....		0.111
Width " medially.....		.031
Quadrate, greatest length.....		.099
" width of ala.....		.066
" thickness behind.....		.03
" length distal extremity.....		.043
Pterygoid, length six alveoli.....		.055
Anterior dorsal, length centrum.....		.059
" " width cup.....		.0515
" " depth ".....		.038
" " expanse poster. zygapophyses.....		.0395
" " " diapophyses.....		.091
" " width neural canal.....		.0135
" " depth ".....		.011
Posterior " " ball.....		.049
" " width ".....		.0425
" " length centrum.....		.0555
" " expanse diapophyses.....		.088

Scapula length.....	.145
" width proximal.....	.07
" " median.....	.112
Coracoid width, proximal.....	.066
Humerus length.....	.154
" width proximal.....	.119
" " median.....	.075
" " distal (restored from <i>C. propython</i>).....	.158
Radius length.....	.115
" width proximal.....	.061
" " distal (oblique).....	.105
Carpal length.....	.04
" width.....	.037
Metacarpal length.....	.095
" width proximally.....	.045
" " medially.....	.018
" " distally.....	.034
Phalange (medial) length.....	.085
" " width proximally.....	.027
" (distal) length.....	.059
" " width distally.....	.0082
Ramus mandibuli, depth in front of cotylus056
Cervical rib, length.....	.074

The total length of the anterior limb could not have been less than 0.90 M., which allows of five phalanges in the longest digit. There may have been more. That the digits were of unequal length is indicated by portions of two in matrix accompanying the specimens, where the articulation of two phalanges falls opposite the shaft of one of the adjoining digit. The phalanges were separated by a short interval of cartilage.

The size of this reptile was near that of *L. validus*, perhaps thirty-five to forty feet in length.

The affinities of this species as incidentally pointed out, are to those *Liodons* which approach *Clidastes*. This is indicated by the many pterygoid teeth, the rudimental zygosphen articulation, the regular striæ of the bones, and the forms of the limb bones. In *Mosasaurus* the humerus is shorter and the phalanges are longer.

The specimens on which this species rests were discovered by Prof. B. F. Mudge, formerly State Geologist of Kansas, now Professor of Geology in the State Agricultural College of Kansas, on the north bank of the Smoky Hill River, thirty miles east of Fort Wallace, Kansas.

Numerous fragments of another larger individual were found by Prof. Mudge near the same locality, which belong probably to the same species. Among them is a portion of the maxillary bone with bases of two teeth; the bases of the crowns where broken off are not compressed, but slightly oval. A radius is a flat bone, more dilated at one extremity than that of *Clidastes propython*.

	M
Length of radius.....	0.108
Width do. narrower extremity.....	.064
“ “ wider “08
“ “ medially.....	.042

This species cannot be confounded with the *L. proriger*, Cope, and *L. congrops*, Cope, owing to its depressed vertebral centra; from *L. mitchillii*, DeKay, the equal and numerous pterygoid teeth separate it at once.

LIODON MUDGEI, Cope.

I am not quite sure whether this species belongs to this genus or to *Mosasaurus*. The characters of its quadrate bone, size, &c., induce me to refer it provisionally to the former.

Its determination rests on a series of specimens from the yellow chalk at a point six miles south of Sheridan, Kansas. They consist of three vertebrae and fragments of atlas, with numerous portions of cranium and proximal extremity of scapula.

The parts of *cranium* preserved are the frontal bone without the anterior extremity, and with the adjacent parietal almost complete, parts of the basisphenoid, the suspensorium, the ossa quadrata, and the greater part of the articular. The frontal is flat with thin edge, longitudinally hollowed on each side of the median line, which is marked by a low but acute keel. There is an abundance of foramina and delicate grooves on the surface, and posteriorly elevated striae, which converge to the median keel. The median square projection of the border of the parietal is in advance of the lateral portion of the same, and not behind it as in *Clidastes propython*. The fontanelle is large. A marked feature is that the parietal crests unite into a low median ridge a short distance behind the fontanelle and are not, as in *Clidastes propython*, separated by a horizontal plane. The sutures of the bones forming the side of the brain-case are very obscure. Nevertheless it appears that the descending margin of the parietal does not descend to the front of the alisphenoid, but is margined inferiorly by the latter to the postorbital expansion. No part of the inferior margin of the alisphenoid can reach the sphenoid, as it terminates in a thin edge except for a short distance medially where it is broken off.

The inferior aspect of the parietal and frontal bones presents a furcate keel corresponding to the divergent parietal crests, and a very large funnel for the epiphysis of the brain. The olfactory groove is deep and regular.

The *articular* bone is characterized by the prominent longitudinal crest which descends on the inner side, from the front of the glenoid cavity to below the posterior attachment of the coronoid bone, where it terminates in a thin edge. Also by the short distance between the margin of the glenoid cavity (cotylus) to commencement (or end) of coronoid suture, indicating a shortening of the posterior part, at least, of the cranium. The bone is continued forwards only immediately under the coronoid (cfr *L. ictericus*).

The proximal extremity of the *quadrate* is characteristic, and exhibits features intermediate between those of *Liodon ictericus*, Cope, and the typical species of *Mosasaurus*, as *M. fulciatus*, *M. dekayi*, &c. The proximal articular face is much like that of *M. depressus* (Trans. Amer. Philos. Soc., 1869, p. 181, Fig. 48, No. 3). The external angle is much smaller than in the *Liodons* and more anterior, nevertheless it is continued distally as a ridge-like angle separating the antero-lateral from the postero-lateral faces as in them, and not presenting the gradual blending of the two surfaces characteristic of the genus *Mosasaurus*. The postero-lateral face is thus flat proximally, and the meatal pit, which is well developed, cannot be seen from the antero-lateral face. The distal part of the quadrate is lost, so that I cannot determine the character of the ridges there.

The basal element of the axis bears a strong hypapophysis without articular faces, but very rugose surfaces. The same portion of the atlas is a convex parallelepipedon, with median rugose tuberosity and very rugose extremities. Its surface is not separated from its body anteriorly by a deep groove as in *L. ictericus*.

The articular facets of the *scapula* are much broader than in the other species here described, indicating a head or wider articulation of humerus. No limb bones were preserved.

The vertebræ are too much injured to be characteristic, with one exception. This one is a posterior dorsal, and had had compressed centrum, or at least not depressed. The inferior face is convex transversely, and there is a slight concavity below each diapophysis.

<i>Measurements.</i>	<i>M.</i>
Parietal, length.....	0.074
“ width between anterior and crests.....	.048
“ least width.....	.022
Frontal interorbital width.....	.092
Quadrate width above.....	.02
“ length from pit to proximal end.....	.023
Articular, length lower edge.....	.015
“ depth in front of cotylus.....	.35
“ “ at end coronoid.....	.055
Posterior dorsal length.....	.0495
Scapula proximal width.....	.051

This species differs from all those of *Mosasaurus* and *Liodon*, in which the form of the quadrate is known in the character of that bone. From *L. lævis* and *L. congrops* in which that element is unknown, it differs in the stouter or less slender vertebræ; from *L. proriger* in its much smaller size.

Its size is a little less than the *L. ictericus* or *L. validus*. It is dedicated to Professor Mudge, in recognition of the valuable results of his investigations as State Geologist of Kansas.

CLIDASTES CINERIARUM, Cope.

The largest species of this genus as indicated by the zygosphen articulation of the vertebræ.

The locality where it was found is the same as the last, but the specimens were taken from the gray bed, perhaps the same that produced the *Elasmosaurus platyrurus*, Cope. They consist of vertebræ and pterygoid teeth. There are two anterior dorsals, three lumbar, and one caudal. The articular faces of the caudals are broad vertical ovals. They increase in width on the lumbar till on the last of these they assume the sub-pentagonal form characteristic of many species, and which is still more marked on the caudal. The centrum of the anterior dorsal is much compressed; inferiorly, slightly concave longitudinally, regularly and prominently convex transversely. Conversely, the rims of the cup and ball are strongly expanded, the latter with surrounding groove. The diapophyses of the lumbar are of considerable length, exceeding in this respect those of *Mosasaurus* we possess, where these parts are preserved. On the median of the lumbar the inferior surface of the centrum first becomes truncate or plane, and separated from that below the diapophyses, which become slightly concave. The expansion of the ball becomes more abrupt and striking on these vertebræ. The caudal is a little more compressed than the lumbar, and presents the character of coössified chevron bones. These are slender and longitudinally grooved.

A single pterygoid tooth was found in the matrix on one of the dorsals. The basis is short and much swollen; the crown curved, acute, a little compressed, and with an obtuse cutting edge posteriorly.

Measurements.

Vertebræ, &c, from brown bed.

	<i>M.</i>
Anterior dorsal, length centrum.....	0.0608
“ “ depth articular ball.....	.038
“ “ width “ “038
“ “ diameter behind diapophyses.....	.029
“ “ depth articular face for rib.....	.022
Lumbar, length centrum.....	.06
“ depth ball.....	.037
“ width.....	.039
“ length remnant of diapophysis.....	.046
“ No. 2, length centrum.....	.055
“ “ width zygosphen.....	.0182
Caudal length centrum.....	.041
“ depth cup.....	.04
“ width.....	.04
“ “ basis diapophysis0245
“ “ between chevron rami.....	.0115
Pterygoid tooth height crown.....	.0125
“ “ diameter pedestal.....	.013

This species was found by Prof. Mudge near the locality of the *Liodon mudgei*, six miles south of Sheridan, Kansas.

It is only necessary to compare this species with *C. intermedius*, Leidy,* as the *C. iguanavus* and *C. propython* have depressed vertebral centre. Those of the first are rounded, of the present compressed. The *C. intermedius* also agrees with the two others in the obliquity of the articular faces to the vertical transverse plane of the centrum; in the present species these planes are *parallel*. This species is also larger than the *C. iguanavus*, Cope; the *C. intermedius* is smaller.

There is another species from New Jersey to which it is more nearly allied, a vertebra of which I have described under the head of *Liodon lavis* (Trans. Amer. Philos. Soc., 1869, 205), and figured l. c. Tab. V. fig. 5, under the erroneous name *Macrosaurus validus*. This probably does not belong to the *Liodon lavis*, which does not possess the zygosphen articulation but is most likely allied to the present species, and a true *Clidastes*. When compared with a vertebra from the same position in the column as determined by the position of the diapophyses, the articular faces are still more compressed, and the inferior surface of the centrum instead of being regularly convex, forms a plane separated from lateral concavities by an obtuse angle. There is less expansion of the margins of the cup and ball. The size is also greater. I propose to distinguish this species as *Clidastes antivalidus*, Cope. It is from the darker stratum of the green sand near Medford, New Jersey.

Obituary Notice of SAMUEL VAUGHAN MERRICK, Esq., by DANIEL R. GOODWIN, D. D.

(*Read before the American Philosophical Society*, December 16, 1870.)

Mr. Samuel Vaughan Merrick, who died on the 18th of August last, was, at the time of his decease, among the oldest members of this Society. Elected in 1833, his membership covered more than the average period of a generation. His was a noiseless and unobtrusive, but an eminently active and beneficent life, moving on like the current of a deep and quiet river, silently depositing the accumulations of rich alluvium along its banks, and bearing the freighted wealth of thousands upon its bosom. He was not what is commonly recognized as a great or a distinguished man. His life does not stand out before us in bold relief, in marked individuality, leaving upon the mere casual observer the impression of its definite outline; but was buried and mingled in the moving and surging mass of the world around him. It might be thought fitting, therefore, to dismiss our notice of him in a few passing words; but to me there seem to be special reasons, in this very peculiarity of the case, for pursuing an opposite course; and I shall, therefore, ask the indulgence of the Society in giving a somewhat greater extension to this paper than is usual; though less, after all, than the subject, in my judgment, demands. Great usefulness was Mr.

* Proc. Acad. Nat. Sci., Phila., 1870, p. 4.